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Carcass and Palatability Characteristics of Calf-fed and Yearling Finished Steers

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Steers finished as yearlings produce less tender beef than calf-fed steers. However, fewer "tough" steaks occurred with extended aging times.

Summary

Steers finished in two management systems were used to compare carcass and palatability characteristics. Calves (n=34) were finished on a high concentrate diet for 203 days. Yearlings (n=42) grazed forages followed by 93 days on a high concentrate diet. Calves had higher marbling scores, lower shear force values and higher sensory ratings for tenderness, flavor and overall acceptability. Compared at equal marbling scores, calves had lower shear force values and higher sensory ratings for tenderness and overall acceptability. The risk of steaks being classified as "tough" was higher in yearlings, but relatively low, especially at extended aging times.

Introduction

An intensive method of finishing cattle consists of calves entering a feedlot post-weaning, where cattle are fed a high-concentrate diet ad libitum, to optimize time on feed. These calves commonly are finished and slaughtered at 12-15 months of age and are termed calf-feds. Some extensive management systems include finishing cattle solely on grass or forage, while others include both forage and grain feeding. Cattle which are backgrounded before entering the drylot are slightly older and commonly finished as yearlings. However, meat becomes less tender as the chronological age of an animal increases. Implementing grazing into a beef production system increases utilization of forage, thus decreasing costs associated with drylot feeding and possibly the length of time necessary in the feedlot. Literature suggests cattle on feed, for as little as 90 days, may have similar palatability traits as cattle fed for longer periods of time.

Cooler aging is a common method used to produce a more tender beef product. Aging beef allows naturally occurring enzymes in the muscle to function, thus producing a more tender cut of meat.

Table 1. Carcass characteristics and longissimus muscle proximate composition from calf-fed and yearling steers.

	Calf-feds		Yearlings	
Trait	Mean	SE	Mean	SE
Carcass wt, lb.	718[b]	10.59	843[c]	9.53
Fat thickness, in.	0.60	0.03	0.56	0.03
Adj. fat thickness, in.	0.65	0.03	0.60	0.02
Longissimus muscle area, in.^{2}	11.3[b]	0.16	12.7[c]	0.14
Kidney, pelvic, heart fat, %	2.1	0.07	1.95	0.07
Yield grade	3.7	0.08	3.5	0.07
Marbling score[a]	511[b]	13.18	353[c]	11.86
Moisture, %	66.44[b]	0.37	72.29[c]	0.33
Fat, %	11.85[b]	0.48	6.82[c]	0.44
Ash, %	1.54[b]	0.03	1.32[c]	0.03

[a]Marbling score: modest = 500-599; small = 400-499; slight 300-399.
[b,c]Means on the same row without a common superscript are different (P < 0.05)

Table 2. Palatability traits and shear force values for loin steaks aged 7, 14, and 21 days from calf-fed and yearling steers.

		Calf-feds		Yearlings	
Aging Time	Trait[a]	Mean	SE	Mean	SE
7 day	Juiciness	5.18	0.08	4.99	0.08
	Tenderness	5.61[b]	0.09	4.84[c]	0.08
	Flavor	4.93[b]	0.06	4.70[c]	0.05
	Overall acceptability	5.07[b]	0.08	4.62[c]	0.07
	Shear force, lb.	6.02[b]	0.23	8.49[c]	0.20
14 day	Juiciness	4.93	0.08	4.72	0.08
	Tenderness	5.64[b]	0.09	4.90[c]	0.08
	Flavor	4.98[b]	0.06	4.74[c]	0.05
	Overall acceptability	5.03[b]	0.08	4.62[c]	0.07
	Shear force, lb.	5.58[b]	0.23	7.85[c]	0.20
21 day	Shear force, lb.	5.32[b]	0.23	7.28[c]	0.20

[a]Means based on an eight-point scale (8 = extremely desirable, 7 = very desirable, 6 = moderately desirable, 5 = slightly desirable, 4 = slightly undesirable, 3 = moderately undesirable, 2 = very undesirable, 1 = extremely undesirable).
[b,c]Means on the same row without a common superscript are different (P < 0.05).

The objective of this study was to compare differences in carcass traits and palatability characteristics in calf-fed versus yearling steers.

Procedure

Seventy-six crossbred steers were evaluated in two management systems. All calves were weaned and the steers were separated into the two treatments at the same time. Thirty-four steers were finished as calf-feds and 42 as yearlings. Calf-fed steers entered the feedlot with a 28-day receiving period, followed by a 5-week period of increasing concentrate formula up to 90% concentrate (12% CP). These steers were given ad libitum access for 203 days. Yearling steers were drylotted for 60 days until corn stalks were available for grazing. Corn stalks were grazed for 78 days, followed by a 64-day period in the drylot. Spring and summer grasses then were grazed for 96 days before a 93-day finishing period in the feedlot with the same feeding formula received by calf-fed steers. Calf-fed and yearling steers were fed to a target fat thickness endpoint of 0.5 inch at the 12th rib.

The cattle were harvested in a commercial packing plant and the carcasses were chilled. At 48 hours post-mortem, carcass data for yield and USDA quality grades were collected. Wholesale loins from the left side of each carcass were collected and transported to the University of Nebraska Meat Laboratory.

At 7 days post-mortem one steak was removed from the 13th rib area and frozen for proximate analysis. The remaining portion of each loin then was fabricated into one-inch thick steaks for Warner-Bratzler shear force determinations and consumer sensory taste panel. Steaks for shear force were classified into aging treatments of 7, 14 and 21 days. Steaks for consumer sensory taste panel were aged for 7 and 14 days. All steaks were vacuum-packaged and frozen until used for further testing.

For consumer taste panel determination, 3-4 steaks were thawed and broiled on Farberware Open-Hearth Broilers to a final internal temperature of 158°F. Immediately after cooking, each steak was sectioned into 1/2" x 1/2" x 1" portions and kept warm in double-boiler units. A consumer sensory taste panel, averaging 29 members (range: 21-42), evaluated eight samples, two for each of the four treatments, for 19 consecutive sessions. Juiciness, tenderness, flavor and overall acceptability were rated using an 8-point descriptive scale (8 = extremely desirable, 1 = extremely undesirable). Steaks for Warner-Bratzler shear force measurement were cooked using the same method as for the taste panel. After cooling to room temperature, a minimum of six 1/2 inch cores were removed and sheared in the center with the Warner-Bratzler shear attachment to an Instron Universal Testing Machine.

Shear force values were used to classify steaks as being "tough", "intermediate" or "tender." "Tough" steaks were distinguished as having greater than 10 lbs. of shear force; "intermediate" steaks having from 8.5 to 10 lb., and "tender" steaks having less than 8.5 lb. of shear force.

Results

Carcass Characteristics

Carcass characteristics and chemical analyses means of calf-fed and yearling steers are summarized in Table 1. Yearling steers produced much heavier carcasses with larger longissimus muscle areas (P < 0.01). Calf-fed steers, however, showed substantially higher marbling scores (P < 0.01) and USDA quality grades.

Chemical analyses showed significant differences (P < 0.01) between calf-fed and yearling steers. Fat and ash percentages were higher in calf-fed carcasses, while moisture percentage was higher in yearling carcasses.

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Palatability Traits

Palatability traits for steaks aged 7 and 14 days, and shear force means for steaks aged 7, 14 and 21 days are summarized in Table 2, comparing calf-fed and yearling steers. Tenderness, flavor and overall acceptability ratings were significantly higher ($P < 0.05$) in calf-fed steaks aged 7 and 14 days. In addition, shear force means were significantly lower ($P < 0.01$) for steaks from calf-fed cattle compared at 7, 14 and 21 days of post-mortem aging.

Palatability and shear force values also were analyzed using marbling score as a covariant (Table 3). This enabled us to compare calf-fed and yearling steers at an equivalent marbling score. Sensory tenderness remained significantly higher ($P < 0.01$) for calf-fed steers at 7 and 14 days aging. Overall acceptability ratings were also higher for calf-fed steers at 7 ($P < 0.05$) and 14 ($P < 0.10$) days of post-mortem aging. Flavor differences were no longer significant at equal marbling scores. Shear force means also remained significantly lower ($P < 0.01$) for calf-fed steers at 7, 14 and 21 days of aging.

Figure 1 illustrates the percentage of the calf-fed and yearling steers within each range of shear force at 7, 14 and 21 days of aging. The percentage of animals being classified into the "tough" category was determined using the shear force values at these aging times. No calf-fed steers were classified as "tough" in this study. However, 19%, 11.9% and 4.8% of yearling steers were classified as "tough" at 7, 14 and 21 days of aging, respectively. Post-mortem aging showed a more significant effect on yearling cattle. However, steaks from calf-fed steers were unusually tender in this study.

Although the risk of finding a "tough" loin steak was higher for yearling finished steers than for calf-feds, the frequency was relatively low, especially with extended aging times.

Table 3. Palatability traits and shear force values for loin steaks aged 7, 14, and 21 days from calf-fed and yearling steers adjusted to a constant marbling score.

Aging Time	Trait[a]	Calf-feds		Yearlings	
		Mean	SE	Mean	SE
7 day	Juiciness	5.07	0.09	5.07	0.08
	Tenderness	5.50[b]	0.10	4.92[c]	0.09
	Flavor	4.84	0.07	4.77	0.06
	Overall acceptability	4.97[b]	0.08	4.71[c]	0.07
	Shear force, lb.	6.37[b]	0.24	8.20[c]	0.21
14 day	Juiciness	4.82	0.09	4.80	0.08
	Tenderness	5.53[b]	0.09	4.99[c]	0.09
	Flavor	4.89	0.06	4.81	0.06
	Overall acceptability	4.92[d]	0.08	4.71[e]	0.07
	Shear force, lb.	5.93[b]	0.23	7.56[c]	0.21
21 day	Shear force, lb.	5.67[b]	0.23	6.99[c]	0.21

[a]Means based on an eight-point scale (8 = extremely desirable, 7 = very desirable, 6 = moderately desirable, 5 = slightly desirable, 4 = slightly undesirable, 3 = moderately undesirable, 2 = very undesirable, 1 = extremely undesirable).
[b,c]Means on the same row without a common superscript are different ($P < 0.05$)
[d,e]Means on the same row without a common superscript are different ($P < 0.10$)

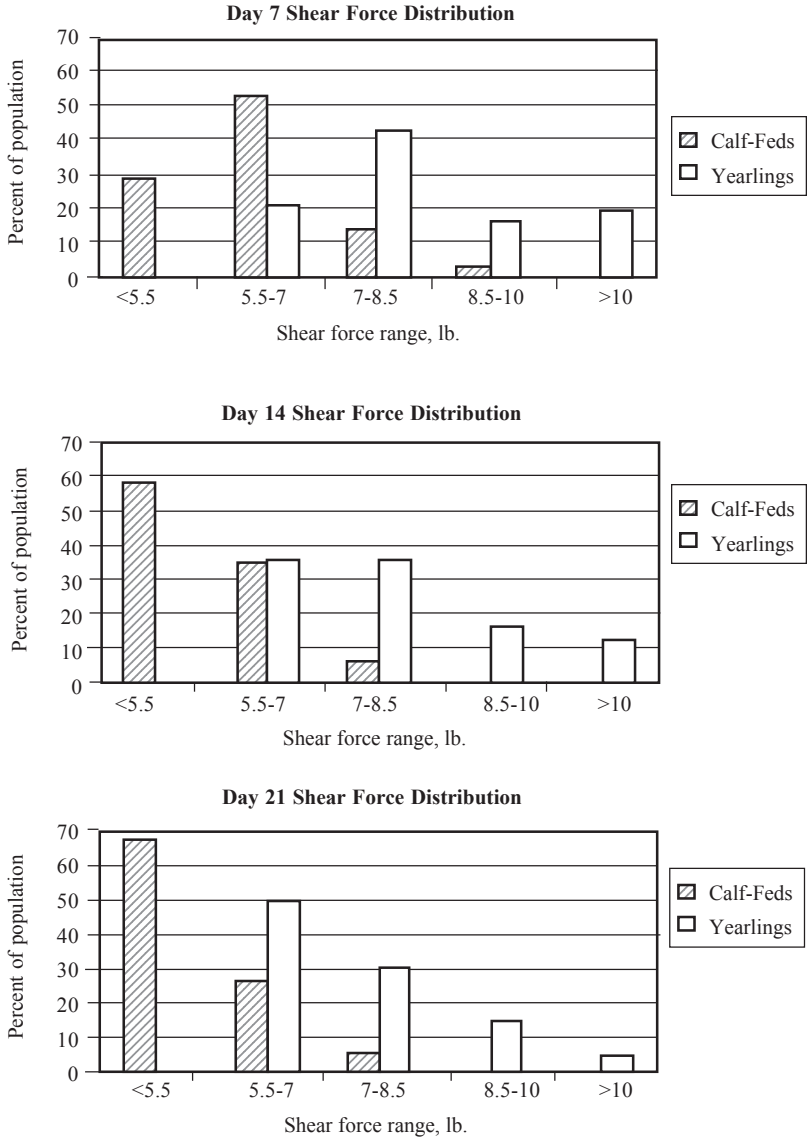

Figure 1. Shear force distribution by aging time.

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